The most devastating disease of citrus worldwide, Citrus Greening (Huanglongbing, HLB)

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Insect Vectored Pathogen

SEM: El-Desouky Ammar, USDA-ARS, Ft. Pierce

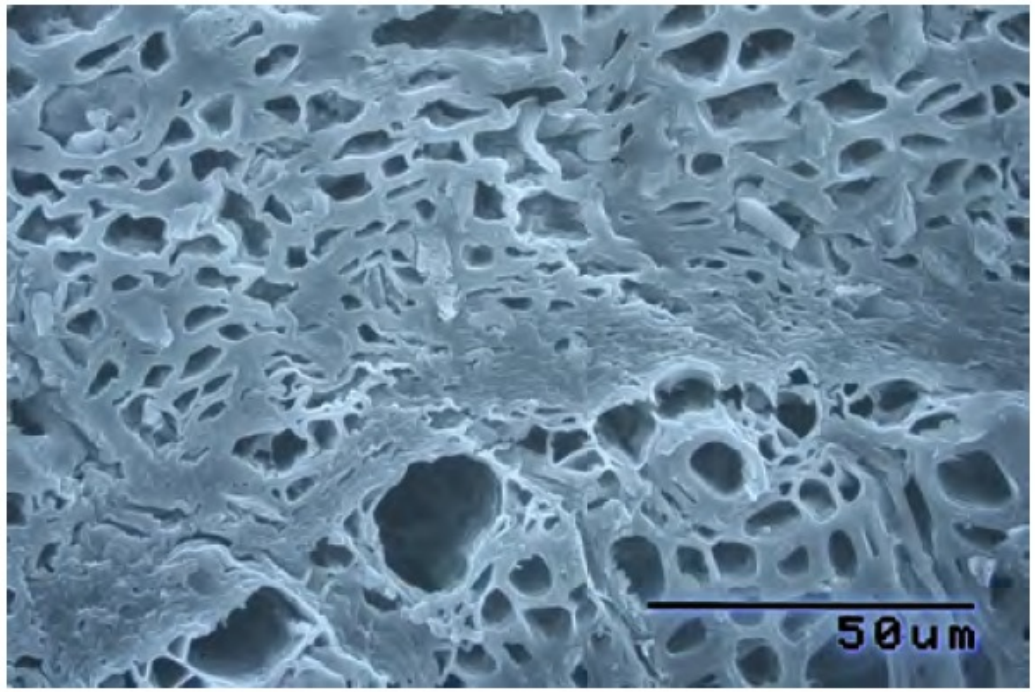


Fig. 9. Cross-section scanning electron micrograph of an HLB-affected petiole at an advanced stage. In this figure, metaphloem tissue has entirely collapsed forming a solid mass of cell wall. The external protophloem and inner part of the cortex are being crushed by the expanding xylem elements.

Etxeberria and Narciso, 2012

'*Candidatus* Liberibacter' (C*Las*)

Phloem-limited bacteria
Disrupts normal transfer of nutrients

Disease Dynamics

What does HLB do to citrus trees?

There is no known cure for HLB.

How does HLB spread?

How is HLB detected?

- Molecular detection assays
- Dependent on contact with material with pathogen
- Can have a delay in detection (9 months to 2 years)
- Early detection is a critical issue

Mitigation strategies

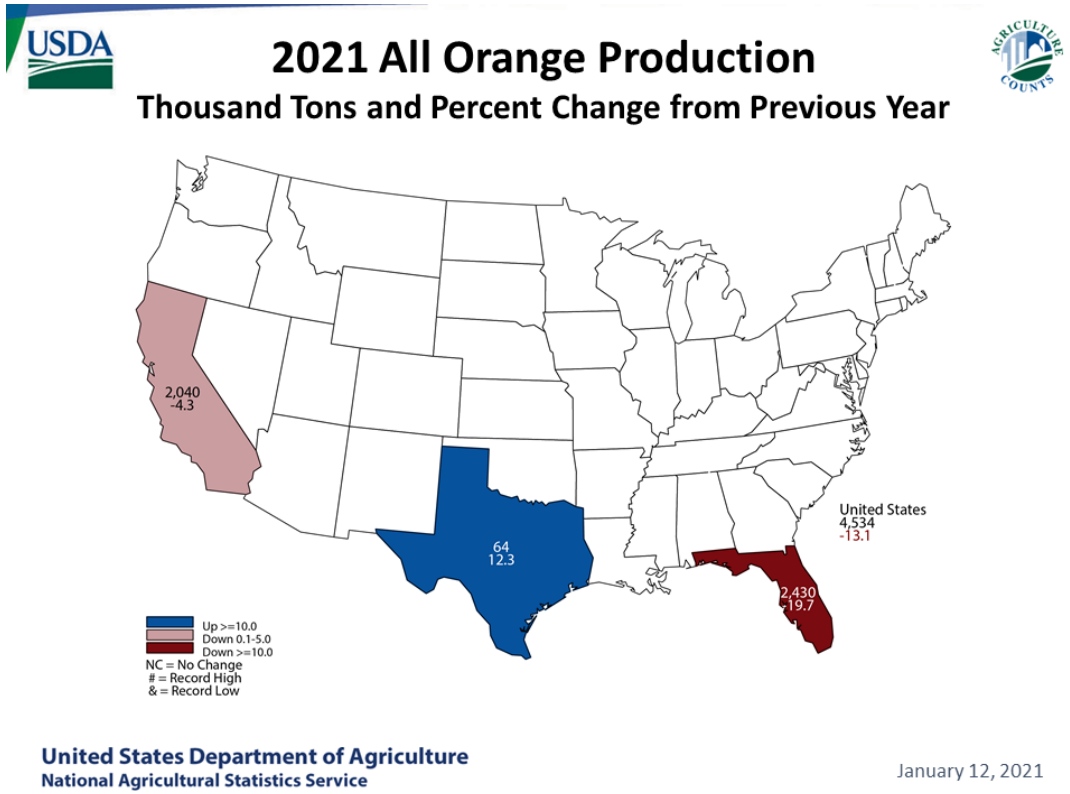
- **1. Vector control**
  - **Insecticide**
    - Eradicative (San Joaquin California)
    - Area wide management
    - Spraying timed with tree phenology
  - **Biological control**
    - Difficult with disease vec extremely low tolerance
  - **Cultural tactics**
    - Netting / screens
    - Protective clay

Mitigation Strategies

- **2. Development of new technologies**
  - Peptides to target pathogen
  - Double stranded RNA to target pest
  - Methods to deliver new tech to fully grown trees
  - Development of tolerant and resistant cultivars through use of breeding and genetic engineering

Where are we currently?

- HLB is widespread in:
  - FL ($800 M, 90/10 juice/fresh)
    - HLB: 2005
  - TX ($100M 60/40 fresh grapefruit/juice)
    - HLB: 2012
- HLB is a developing issue in California
  - CA $4B, fresh fruit
    - HLB 2012
  - No known HLB in commercial citrus
- Strategies are different for emerging disease vs. widespread



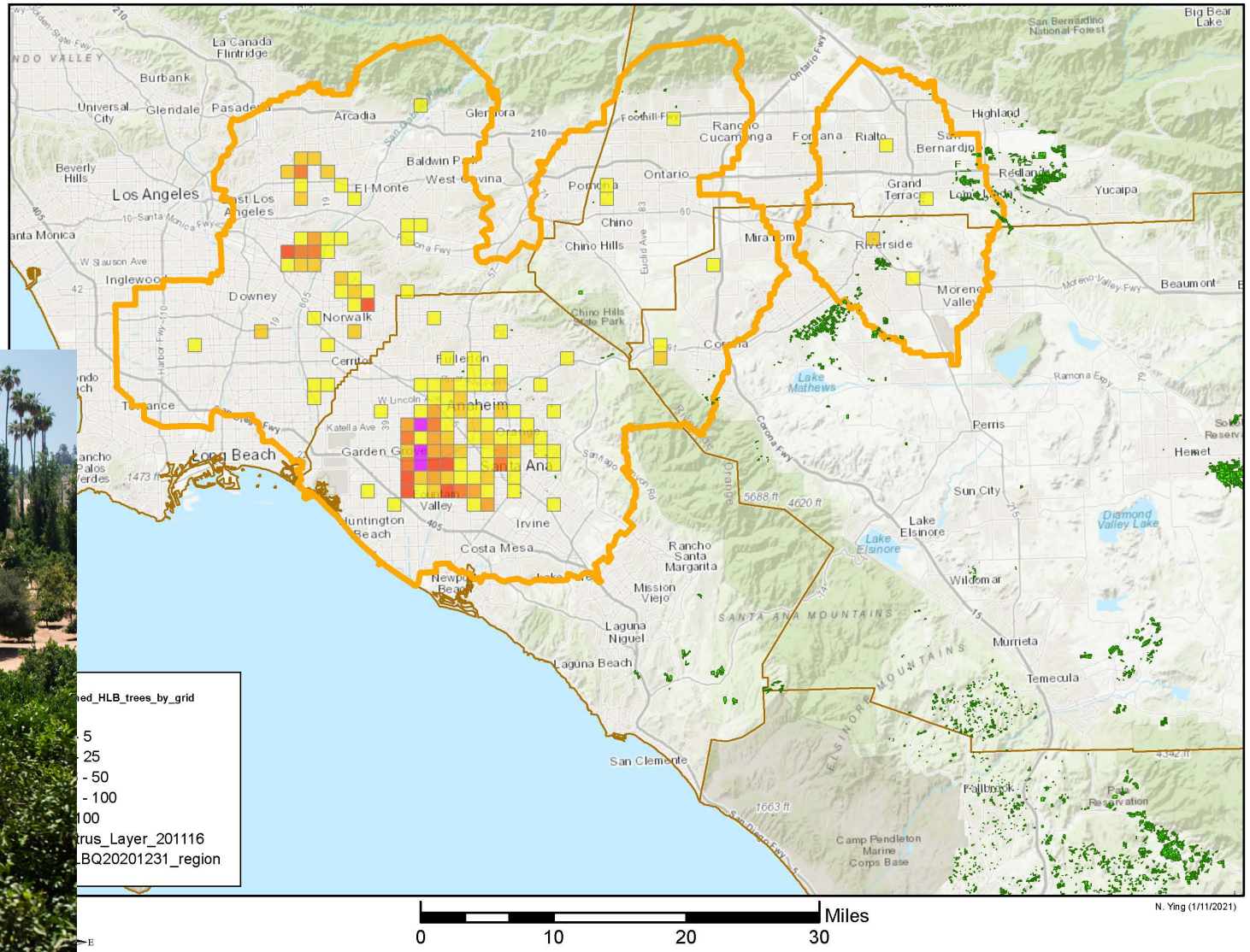
HLB in the Los Angeles basin

The family's fruit stand on Riverside's Van Buren Boulevard, a major thoroughfare. Open seven days a week, it's a local landmark and a "must do" destination for loyal customers. They sell fresh citrus picked daily and fresh-squeezed orange juice plus Gless Ranch avocados and dates. They also offer dried fruits and nuts, and jams and jellies.

CITRUS PEST & DISEASE PREVENTION DIVISION
CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

California HLB Detections

Infected Trees by Grid - Mapped 1/11/2021



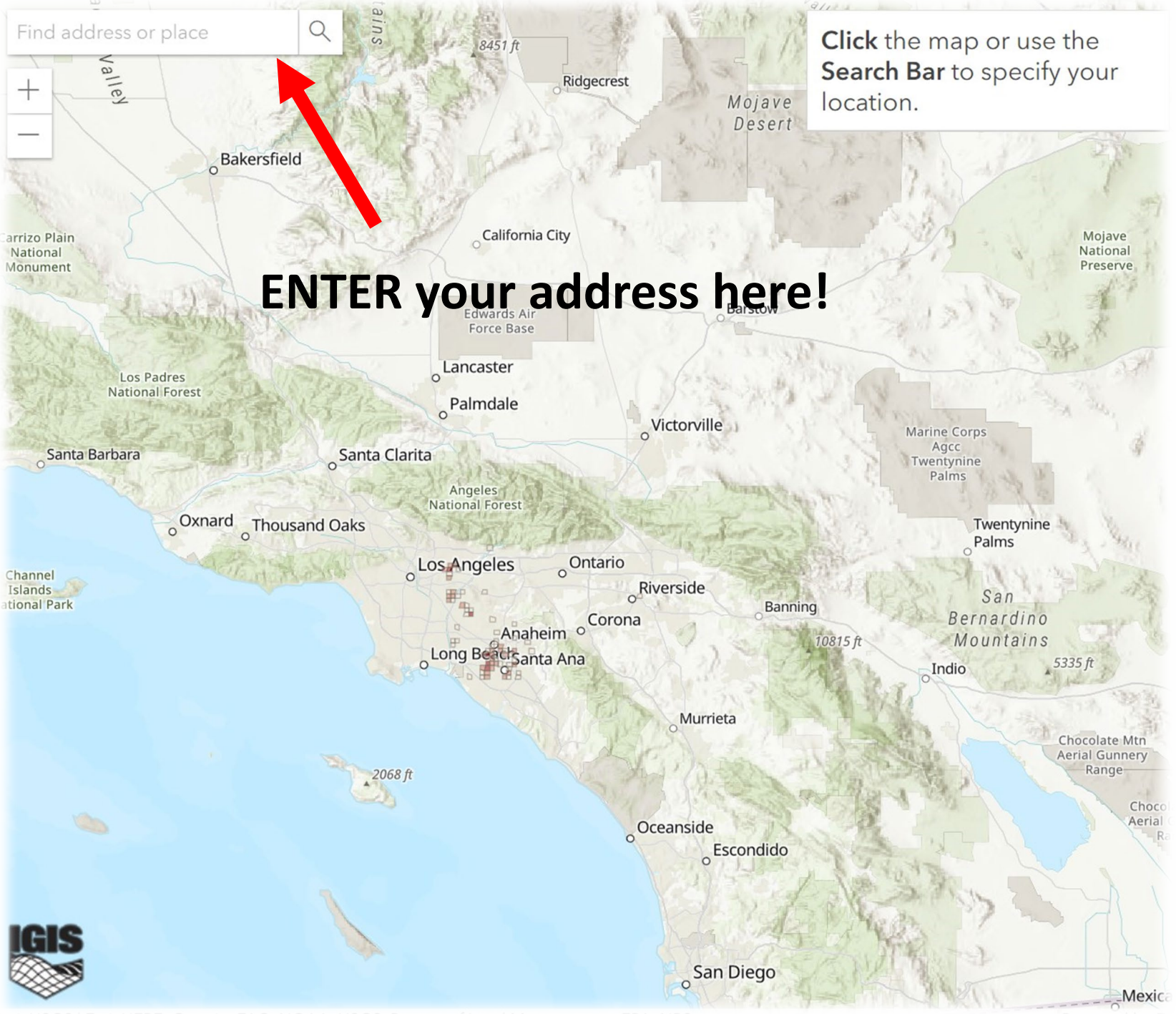
Why is it spreading slower in California?

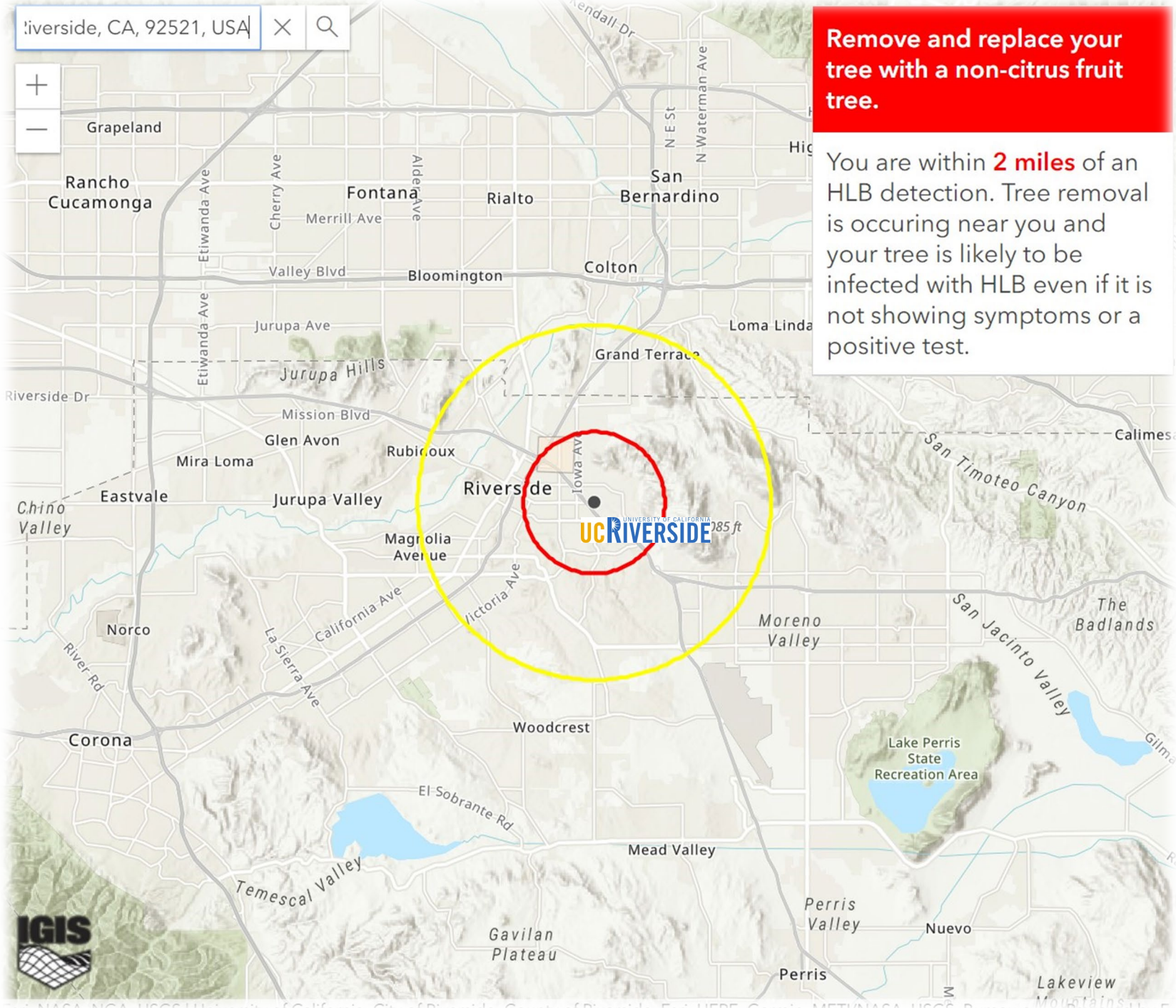
- **Five reasons**
  - Major weather differences
  - Millions of dollars/year spent by state to monitor, treat and remove infected trees in LA basin
  - Area-wide management
  - Science-based regulations
  - Geography

What is being done in California?

- Extension a.k.a. Outreach or Science Communication
  - Growers/Farmers
  - Public
- California Based Research

http://ucanr.edu/hlbapp




iverside, CA, 92521, USA
Remove and replace your tree with a non-citrus fruit tree.
You are within 2 miles of an HLB detection. Tree removal is occuring near you and your tree is likely to be infected with HLB even if it is not showing symptoms or a positive test.
Grapeland
Rancho Cucamonga
Fontana
Rialto
San Bernardino
Colton
Bloomington
Loma Linda
Grand Terrace
Jurupa Hills
Riverside Dr
Mission Blvd
Glen Avon
Mira Loma
Eastvale
Jurupa Valley
Riverside
UC RIVERSIDE
Calimesa
San Timoteo Canyon
Chino Valley
Norco
Corona
Woodcrest
Moreno Valley
The Badlands
San Jacinto Valley
Lake Perris State Recreation Area
El Sobrante Rd
Mead Valley
Temescal Valley
Gavilan Plateau
Perris Valley
Nuevo
Perris
Lakeview
Merrill Ave
Valley Blvd
Jurupa Ave
Etiwanda Ave
Cherry Ave
Alder Ave
N E St
N Waterman Ave
Iowa Ave
Victoria Ave
California Ave
La Sierra Ave
River Rd
Magnolia Avenue
IGIS

Developing tools for organic growers

- ACP populations build in organic fields
  - Low efficacy products
  - Few options for control
  - High risk of insecticide resistance

Pink Kaolin Clay

- **Hypotheses**:
  - Enhances plant growth
  - Repels ACP better than undyed white kaolin
    - Visual cue for ACP disrupted

Essential oil-based repellent bars

- 20% fir oil
- Development:
  - Density
  - What trees are ideal for this tool
  - Repellency over time

Understanding phenology of HLB in ACP

- Sampling project
- 15 sites in three citrus production regions

- Goals:
  - Determine **% of HLB+ ACP in commercial groves**
  - Understand the **phenology** (presence over time) of HLB+ ACP
  - Determine **%number of ACP color morphs** in the field

Understanding the best use of insecticides

- Climate and soil variation through state
- Understanding what insecticides work best and preserve natural enemies
- Understanding efficacy of new products coming to market

Thank you!

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